

JPRS 68362

14 December 1976

U S S R

USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS  
GEOPHYSICS, ASTRONOMY AND SPACE  
No. 386

EAST  
EUROPE

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<b>BIBLIOGRAPHIC DATA SHEET</b>	1. Report No. <b>JPRS 68362</b>	2.	3. Recipient's Accession No.
4. Title and Subtitle <b>USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS - GEOPHYSICS, ASTRONOMY AND SPACE, No. 386</b>		5. Report Date <b>14 December 1976</b>	6.
		8. Performing Organization Rept. No.	
9. Performing Organization Name and Address <b>Joint Publications Research Service 1000 North Glebe Road Arlington, Virginia 22201</b>		10. Project/Task/Work Unit No.	
		11. Contract/Grant No.	
12. Sponsoring Organization Name and Address  <b>As above</b>		13. Type of Report & Period Covered	
		14.	
15. Supplementary Notes			
16. Abstracts  The report contains abstracts and news items on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial physics, covering both science news and formal scientific reports. Published details of Soviet space spectacles are included.			
17. Key Words and Document Analysis. 17a. Descriptors  USSR Geophysics Astronomy Astronautics Meteorology Oceanography  17b. Identifiers/Open-Ended Terms  17c. COSATI Field/Group <b>3, 4A, 4B, 8, 22</b>			
18. Availability Statement <b>Unlimited Availability Sold by NTIS Springfield, Virginia 22151</b>		19. Security Class (This Report) <b>UNCLASSIFIED</b>	21. No. of Pages <b>46</b>
		20. Security Class (This Page) <b>UNCLASSIFIED</b>	22. Price

14 December 1976

# USSR AND EASTERN EUROPE SCIENTIFIC ABSTRACTS

## GEOPHYSICS, ASTRONOMY AND SPACE

No. 386

This serial publication contains abstracts of articles from USSR and Eastern Europe scientific and technical journals on the specific subjects reflected in the table of contents.

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	CONTENTS	PAGE
I.	ASTRONOMY.....	1
	News.....	1
	New Radiotelescope Built in Kazakh SSR.....	1
	Abstracts of Scientific Articles.....	2
	Automated Radar Observations of Meteors.....	2
	Active Regions and Disturbances of Interplanetary Medium.....	2
II.	METEOROLOGY.....	4
	News.....	4
	Monograph on Laser Sounding of Clouds.....	4
	Abstracts of Scientific Articles.....	5
	Predicting Climatic Change and Level of Caspian Sea.....	5

	<u>Page</u>
Modification of Hail Processes.....	5
Modification of Altocumulus Clouds.....	6
Climatological Processing of Drifting Station Data.....	6
Wind and Pressure Gradient Fields in Equatorial Latitudes.....	7
III. OCEANOGRAPHY.....	8
News.....	8
New Association for Sea Navigation Formed.....	8
Monograph on Turbulent Structure of Ocean.....	9
Abstracts of Scientific Articles.....	10
Short-Wave Internal Waves in Ocean.....	10
Small-Scale Oceanic Turbulence.....	10
Turbulent Energy and Mass Exchange in Near-Water Layer of Atmosphere.....	11
Fine Structure of Hydrophysical Fields in Ocean.....	11
Space Observations of Internal Waves.....	12
System for Processing-Analyzing Oceanographic Data.....	12
Method for Studying Sand Waves on Sea Floor.....	13
Attenuation of Internal Gravitational Waves.....	13
Reflection of Long Waves from Walls of a Rotating Channel.....	14
Geological Possibilities of Marine Magnetometry.....	14
Development of Plane Internal Waves.....	15
Small-Scale Turbulent Structure of Ocean.....	15
Fine Vertical Structure of Hydrophysical Fields.....	16

IV. TERRESTRIAL GEOPHYSICS.....	<u>Page</u> 17
News.....	17
Development of Unified Seismic Observations System.....	17
Earthquake Reported Near Dushanbe.....	18
Abstracts of Scientific Articles.....	19
Tectonic Lineaments and Relationship to Earthquake Foci.....	19
Procedures in Radiogeodetic Measurements.....	20
Investigations of Bottom Relief and Geomagnetic Field.....	20
Experimental Travel-Time Curve of PcP Wave.....	21
Earthquakes, Nonuniformity of Rotation of Earth, D-Waves.....	21
Experimental P-Wave Travel-Time Curve and Mantle Inhomogeneity..	22
Seismological Prediction in Rumania.....	22
Multipath Propagation of Seismic Signals in Crustal Studies.....	23
Annular Structures and Linear Faults on Aldanskiy Shield.....	23
Accuracy of Geodetic Tie-in in Marine Surveys.....	24
Problems in the Theory of Tectogenesis.....	24
Aircraft Measurement of Gravity.....	25
Magnetic Anomalies Along Ashkhabad-Tashauz Profile.....	25
Seismotectonic Map of Rumania.....	26
V. UPPER ATMOSPHERE AND SPACE RESEARCH.....	27
News.....	27
TASS Reports "Salyut-4" Station's Completion of 22 Months in Orbit.....	27
TASS Announces Launching of "Kosmos-864".....	27

	<u>Page</u>
TASS Announces Launching of "Ekran" Television Broadcasting Satellite.....	28
TASS Announces Launching of "Kosmos-866".....	29
"EKTRAN" Satellite Put into Stationary Circular Orbit.....	29
TASS Announces Launching of "Kosmos-865".....	30
Abstracts of Scientific Articles.....	31
Diffuse Reflection of Radiation by Planetary Atmosphere.....	31
Mesospheric Turbidity.....	31
Inverse Problem in Optical Sounding.....	32
Spectral Brightness of Noctilucent Clouds.....	32
Magnetic Regions in Streams of Interplanetary Plasma.....	33
Excitation of Drift Instability in Upper Ionosphere.....	34
Determining Radiation Transfer Equation Solution.....	34
Proton Component of Radiation Belts.....	34
Dynamics of Electrons in Radiation Belts.....	35
Ground Methods for Investigating Cosmic Rays.....	35
Magnetic Variations in Polar Region.....	36
Artificial Ionization of Ionosphere.....	36
Inverse Problem of Global Ionospheric Sounding.....	36
VI. MISCELLANEOUS.....	38
News.....	38
Scientists Depart for Antarctic Expedition.....	38

## I. ASTRONOMY

### News

#### NEW RADIOTELESCOPE BUILT IN KAZAKH SSR

Moscow IZVESTIYA in Russian 28 Oct 76, p 6

[Article by O. Ognev: "To the Secrets of the Universe"]

[Text] Alma-Ata. A radiotelescope has been constructed 2,700 m above sea level in the Zailiyskiy Alatau Mountains. It is intended for solving tasks in solar radioastronomy. The large number of clear days will make possible an increase in the number of observations and will ensure a high quality of the data received in the millimeter and centimeter wavelength bands.

Scientists of the republic Academy of Sciences will receive a superior instrument for investigating solar activity.

## Abstracts of Scientific Articles

### AUTOMATED RADAR OBSERVATIONS OF METEORS

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 10, 1976, pp 89-94

[Article by Corresponding Member USSR Academy of Sciences V. V. Fedynskiy, B. L. Kashcheyev, Yu. I. Voloshchuk and A. A. D'yakov, "Radar Observations of Meteors Using Automated Systems"]

[Abstract] In the 1970's specialists at the Khar'kov Radioelectronics Institute created an automatic computerized complex of instruments for the registry and processing of data from radar observations of meteors. This automated system includes a statistical analyzer of the number of meteor reflections (SANMO) and a system for the automatic processing of individual radiants and meteor orbits (SAPIMRO). The process of processing information obtained with the radar system can be divided into three parts: preliminary, primary and secondary processing. The preliminary stage involves detection and discrimination of the signal against a noise background, primary processing involves determination of its parameters and its representation in a form suitable for secondary processing, including in the computations the physical characteristics of the meteor and its trajectory in space. The instrumentation is designed for joint measurements of the number, individual velocities and radiants of meteor particles. The structure and functioning of all components are discussed. It has been established that for processing the daily volume of information from the meteor complex (on the average 400 orbits of sporadic meteors and 30,000 records of number) with registry on motion picture film it is necessary to expend 12-14 man-days for processing orbits and 35-40 man-days for processing meteor number, whereas the SANMO and SAPIMRO supply this information in the course of measurements with an expenditure of three man-days (three-shift work of operators).  
[94]

### ACTIVE REGIONS AND DISTURBANCES OF INTERPLANETARY MEDIUM

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8A 139

[Abstract of article by N. N. Konor, G. P. Lyubimov, T. G. Khotilovskaya and Ye. P. Zaborova; Moscow, IZV. AN SSSR, SER. FIZ., 40, No 3, 1976, pp 477-483, "Strong Active Regions and Disturbances of the Interplanetary Medium"]

[Text] On the basis of a statistical analysis of solar data the authors have introduced the concept of a strong active region. Virtually all strong flares occur in strong active regions constituting about 10% of the total number of active regions on the sun. A study was made of the possible types of disturbance of the interplanetary medium by processes in strong active regions on the sun; it is shown that these disturbances exert a significant influence on diffusional-convective propagation of low-energy protons in the quasi-stationary anisotropic interplanetary medium, leading to the appearance of different modulation effects in cosmic rays. Bibliography of 16 items.

[109]

## II. METEOROLOGY

### News

#### MONOGRAPH ON LASER SOUNDING OF CLOUDS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8B 312K

[Abstract of monograph by G. M. Krekov, M. M. Krekova, E. V. Makiyenko and I. E. Naats, Institute of Atmospheric Optics, Siberian Department USSR Academy of Sciences; Tomsk, LAZERNOYE ZONDIROVANIYE OBLAKOV (TEORETICHESKIYE ASPEKTY), Preprint No 8, 1975, 68 pages]

[Text] The authors have systematized existing methods for laser sounding of single-component scattering media of the type of clouds, fogs and sea water. The monograph gives a number of new algorithms for reconstructing the spatial distribution of optical parameters in the limits of the scattering medium on the basis of data from single-frequency sounding. The authors present a comparative analysis of the effectiveness of the cited methods under the conditions of a multiple-scattering background. Particular attention is devoted to an evaluation of the influence of a priori assumptions on the accuracy of solution of the ranging equation and search for methods for increasing the stability of these solutions in the field of large optical thicknesses. For the first time the authors have examined the problems of determining the vertical stratification of microphysical characteristics of the cloud cover (liquid-water content, quantitative concentration, spectrum of particle sizes) using data from multifrequency sounding.

[109]

### Abstracts of Scientific Articles

#### PREDICTING CLIMATIC CHANGE AND LEVEL OF CASPIAN SEA

Baku IZVESTIYA AKADEMII NAUK AZERBAYDZHAN. AKADEMII NAUK, SERIYA NAUK O ZEMLE in Russian No 3, 1976, pp 13-25

[Article by E. M. Shikhlinskiy, "Possibility of Predicting Changes in Climate and Level of the Caspian Sea for Different Times in Advance"]

[Abstract] In this article the author has formulated new methods for predicting natural phenomena in climatic changes and fluctuations. The natural phenomena detected by examination of climatic changes in the continuous succession of seasons and the derived correlations between quantity of precipitation, air temperature and Wolf numbers may be used as a basis for predicting the average air temperature and the average quantity of precipitation (for half-years, seasons and a year) for five or ten years in advance. Two groups of correlations were obtained between the level of the Caspian Sea, Wolf numbers, air temperature and precipitation. They may be used for prediction of the average level of the Caspian Sea for the coming five or ten years (on the condition that there is no vertical motion of the floor of the Caspian Sea).

[98]

#### MODIFICATION OF HAIL PROCESSES

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8B 632

[Abstract of article by A. I. Kartsivadze, T. G. Salukvadze and V. A. Lapinskas; Tbilisi, TR. IN-T GEOFIZ. AN GRUZ SSR, 36, 1975, pp 13-27, "Some Problems in the Method for Modifying Hail Processes with Use of the 'Alazani' Antihail System"]

[Text] In evaluating the presently known methods for hail detection and means for the delivery of reagents into convective clouds, the authors formulate a method for detecting a hail focus in a cloud based on the change in several parameters relating hail phenomena and changes in the dynamics of cloud development. The article sets forth the principles of the method for injecting the reagent into the clouds by means of rockets, in particular, the new "Alazani" complex. Bibliography of 11 items.  
[109]

#### MODIFICATION OF ALTOCUMULUS CLOUDS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8B 627

[Abstract of article by Ye. I. Kravchenko, S. K. Kudryavtseva and I. P. Polovina; --, TR. UKR. N.-I. GIDROMETEOROL. IN-T, No 144, 1976, pp 78-84, "Investigation of the Process of Crystallization and Dispersal of Middle-Level Clouds"]

[Text] On the basis of the results of 55 experiments for the modification of altocumulus clouds it was possible to investigate the peculiarities of the process of their crystallization and dispersal. The time required for broadening the zones of crystallization during modification of middle-level clouds most frequently is 35-50 minutes. The width of the crystallization zone most frequently attains 5,000-6,000 m. The mean rate of expansion of the crystallization zone during modification of middle-level clouds most frequently is 91-120 m/min. Middle-level clouds are characterized by an increase in the rate of expansion of the zone with time. Bibliography of six items.  
[109]

#### CLIMATOLOGICAL PROCESSING OF DRIFTING STATION DATA

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8B 558

[Abstract of article by Z. M. Prik; Leningrad, TRUDY ARKT. I ANTARKT. NII, 328, 1976, pp 4-21, "Climatological Processing of Materials from Meteorological Observations Carried Out at Drifting Stations"]

[Text] The methods for climatological processing of materials from meteorological observations carried out at drifting stations are described: 1) reduction of meteorological elements to a long-term period (data on pressure and air temperature); 2) obtaining long-term values using data for groups

of stations; 3) determination of mean and extremal values for large regions of the Arctic Basin. Bibliography of nine items.  
[109]

#### WIND AND PRESSURE GRADIENT FIELDS IN EQUATORIAL LATITUDES

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8B 411

[Abstract of article by Yu. A. Romanov and N. A. Romanova; Moscow, REZUL'TATY METEOROL. ISSLED. PO MEZHDUNAR. PROGRAMME "TROPEKS," 1975, pp 8-24, "Experience in Empirical Investigation of the Relationship Between the Wind and Pressure Gradient Fields in Equatorial Latitudes on the Basis of Observations of the TROPEKS-72 Expedition"]

[Text] On the basis of data from observations of the TROPEKS-72 expedition a study was made of the relationship between wind velocity over the ocean and the pressure gradient at different distances from the equator. In a narrow equatorial zone, 0-5°N, there is no correlation between wind velocity and the pressure gradient. Here one observes negative angles of wind deviation from the pressure gradient (to the left of the gradient). The geostrophic approximation begins to be satisfied to the north of 10-12.5°N. Some considerations are expressed concerning the asymmetry of distribution of the vorticity of wind velocity relative to the axis of the equatorial trough, and also on regions of generation of tropical cyclones.  
[109]

### III. OCEANOGRAPHY

#### News

#### NEW ASSOCIATION FOR SEA NAVIGATION FORMED

Moscow IZVESTIYA in Russian 22 Oct 76, p 4

[Article by V. Shmyganovskiy, "Beacons in the Universe"]

[Excerpts] The time of launching of the first artificial earth satellite was less than 20 years ago, but the field of use of the advances in cosmonautics for the solution of scientific and technical problems has so expanded that astronomers, geologists, foresters, geographers and meteorologists cannot get by without applying the results. And the "intrusion" of cosmonautics into the work of the sea fleet is unexpected even for many writers of science fiction.

"The [newly formed] association," comments the Deputy Minister of the USSR Merchant Marine, A. S. Kolesnichenko, "is not without reason known as 'Morsvyaz'sputnik' [marine communications satellite]. In addition to supplying the fleet with new tracking systems its primary concern will be the problem of communication between the shore and sea -- all-weather, around-the-clock communication not dependent on geographic coordinates and magnetic storms. Such communication can be ensured only by satellites."

Question from interviewer: "In actuality the economic losses sustained by the merchant marine from communication irregularities are very great. In addition, as far as I know, as before it is almost everywhere common to use the Morse code and only 7% of communication is with use of the radio telephone?"

"That's exactly right. And the daily radiotelegraphic exchange between ship and shore is usually very limited. Both sides literally outdo each other in striving to squeeze the necessary information into a communications session! But that's only half the story. The communication often is not at the necessary time, but when the opportunity for it arises. There are cases when there are breaks in the propagation of radio waves up to two days. Take

the Caribbean Sea, some regions of the Pacific and Indian Oceans..."

"Does this mean that it is expected that satellites will take on themselves communication between ship and shore precisely in a regime of radiotelegraphic and radiotelephonic communication?"

"This is a rather simple matter for them. The apparatus will also transmit video images (for example, diagrams of the repair of units and assemblies) and necessary information to the shipboard teletype, facsimile images and also photographs of family members and friends of the ship's crew, including photographs of their children. Space will assist seamen in obtaining precise meteorological forecasts and organizing an effective storm warning system. And if misfortunes occur in the ocean the satellites will rapidly spread the word about the vessel which has experienced trouble, relaying the SOS to rescue ships. After all, the zone of their radiovisibility is virtually unlimited."

"Tens of thousands of ships of different countries now sail the world ocean. Within the framework of the Intergovernmental Marine Consultative Organization are preparations now being made for instituting a world system for space navigation and communication?"

"Without doubt. An agency will be established ensuring the interests of all large and small marine countries in accordance with the requirements of international cooperation in navigation matters. The first step in creating such an organization, INMARSAT (within the framework of the Intergovernmental Marine Consultative Organization) has already been taken with the active participation of the USSR.  
[96]

#### MONOGRAPH ON TURBULENT STRUCTURE OF OCEAN

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8 V40K

[Abstract of monograph (results of symposium); Sevastopol', MATERIALY I VSES. SIMPOZ. PO OKEANICH. TURBULENTNOSTI, KALININGRAD, SENT. 1974, AN SSSR, AN UkrSSR, 1975, 222 pages]

[Text] This publication consists of summaries of reports presented at the First All-Union Symposium on Investigations of Small-Scale Oceanic Turbulence which cover the following matters: genesis and properties of small-scale turbulence, apparatus and research methods, automation of collection and processing of data, metrological support of hydrophysical measurements.  
[109]

## Abstracts of Scientific Articles

### SHORT-PERIOD INTERNAL WAVES IN OCEAN

Moscow OKEANOLOGIYA in Russian Vol XVI, No 5, 1976, pp 782-786

[Article by K. D. Sabinin and A. N. Serikov, Acoustics Institute, "Characteristics of the Spatial Spectrum of Short-Period Internal Waves in the Ocean"]

[Abstract] The application of new methods of adaptive spatial-temporal spectral analysis to long-term measurements in the Indian Ocean using systems of distributed temperature sensors has demonstrated that short-period internal waves in the thermocline are anisotropic and can have a quasi-standing character. Comparison of the Reynolds number in the upper weakly stratified layer of the ocean with the parameters of the internal waves made it possible to formulate the hypothesis that waves are excited due to shear instability in inertial movements.

[100]

### SMALL-SCALE OCEANIC TURBULENCE

Moscow OKEANOLOGIYA in Russian Vol XVI, No 5, 1976, pp 791-797

[Article by V. D. Pozdynin, Institute of Oceanology, "Some Statistical Patterns of Small-Scale Oceanic Turbulence"]

[Abstract] On the basis of measurements in the Lomonosov Current it was possible to derive the empirical formula  $\sqrt{u'^2} = 1.3 Ri^{-0.15}$ , where  $\sqrt{u'^2}$  is the mean square amplitude of current velocity fluctuation,  $\text{cm}\cdot\text{sec}^{-1}$ ;  $Ri$  is the Richardson number. The formula relates to turbulence with scales of perturbations from 2 to 150 cm and to a stationary regime of its generation. From the vertical energy profiles of turbulence it was possible to discriminate water layers with turbulence levels characteristic for them. The totality of such layers at each sounding station can be described by a log-

normal distribution. Convolution of the distributions of thicknesses of the layers with the turbulence levels and current velocities characteristic for them, observed during turbulence measurements, gave the distribution of Reynolds numbers; for the region of Tunis Strait the most probable Reynolds numbers were about  $10^6$ .  
[100]

#### TURBULENT ENERGY AND MASS EXCHANGE IN NEAR-WATER LAYER OF ATMOSPHERE

Moscow OKEANOLOGIYA in Russian Vol XVI, No 5, 1976, pp 918-923

[Article by V. L. Vlasov and V. V. Ipatov, Institute of Oceanology, "Distortion of Values and Spectra of Turbulent Energy and Mass Exchange in the Near-Water Layer of the Atmosphere During Direct Measurements from a Rolling Vessel"]

[Abstract] A theoretical study was made of distortions of cospectra associated with natural spatial-temporal changes in turbulent fluctuations and the nonlinearity of the profile of a passive impurity during periodic movement of the sensors due to rolling. It is demonstrated that the first type of distortions can lead to a steeper (than the  $-5/3$  law) dropoff of the high-frequency part of the cospectrum and to the appearance of extrema. The second type of distortions changes only the quantitative expression of the results obtained earlier in a linear approximation. The theoretical and experimental results are in agreement.  
[100]

#### FINE STRUCTURE OF HYDROPHYSICAL FIELDS IN OCEAN

Moscow OKEANOLOGIYA in Russian Vol XVI, No 5, 1976, pp 750-759

[Article by A. G. Voronovich, A. I. Leonov and Yu. Z. Miropol'skiy, Acoustics Institute, Institute of Mechanical Problems and Institute of Oceanology, "On the Theory of Fine Structure of Hydrophysical Fields in the Ocean"]

[Abstract] In this study, on the basis of the theory of propagation of slightly nonlinear internal waves (Yu. D. Borisenko, et al., IZV. AN SSSR, FIZ. ATMOSFERY I OKEANA, 12, No 3, 1976; A. I. Leonov, et al., J. FLUID MECH., 1976, in press), the authors propose a mechanism of the formation of the fine structure of hydrophysical fields in the ocean. The authors give computations of elements of the fine structure of the velocity and density fields for typical oceanic conditions. The article gives an analysis of available experimental data on oceanic fine structure and their comparison with conclusions drawn on the basis of the proposed theory.  
[100]

## SPACE OBSERVATIONS OF INTERNAL WAVES

Moscow OKEANOLOGIYA in Russian Vol XVI, No 5, 1976, pp 787-790

[Article by K. N. Fedorov, Institute of Oceanology, "Observations of Oceanic Internal Waves from Space"]

[Abstract] The author discusses the different conditions under which it is possible to observe internal waves from artificial earth satellites. There is a discussion of different phenomena at the ocean surface associated with internal waves. In the example of a photograph taken from aboard the American space laboratory "Skylab-4" it is shown that under definite conditions it is not only possible to observe internal waves, but also to evaluate a series of their parameters: phase velocity, period and even direction of propagation. In the case considered, the periods of the observed internal waves occupy some intermediate position between the most frequently encountered periods of internal oscillations in the ocean. In any case, these internal waves are probably not directly related to tidal phenomena as postulated by R. S. Dietz (SEA FRONTIERS, 20, No 6, 1974), who published the photograph. Judging from propagation velocity and the fact that these waves are propagated along the shore, these more likely are internal waves associated with a shore current caused by trade winds.

[100]

## SYSTEM FOR PROCESSING-ANALYZING OCEANOGRAPHIC DATA

Moscow OKEANOLOGIYA in Russian Vol XVI, No 5, 1976, pp 929-934

[Article by L. G. Pechisker, Institute of Oceanology, "Small Graphic System for Processing and Analyzing Series of Oceanological Data"]

[Abstract] The article describes a system for statistical processing and analysis of spatial-temporal series of oceanological data on the basis of graphic interaction in the "experimenter - electronic computer" system. A light pen is used in selecting the processing programs. A BESM-4 computer with information output to a SI-19 oscillograph was used. The structure and operating principle of the system are described in detail. Figure 2 is a structural diagram of the graphic system; Fig. 3 is a block diagram showing the organization of programs in the graphic complex. The principal advantage of computations on the basis of man-computer interaction is that there is facility in interaction between the experimenter and computer. In such an arrangement there is no need for predetermining the sequence of performance of different computations. The choice is based on the knowledge, experience and intuition of the experimenter. This imparts a flexibility to the computations and opens the way to carrying out computations by a broader range of oceanographers since it does not require that they have a knowledge of programming or computers.

[100]

#### METHOD FOR STUDYING SAND WAVES ON SEA FLOOR

Moscow OKEANOLOGIYA in Russian Vol XVI, No 5, 1976, pp 935-938

[Article by V. A. Sychev, P. S. Chakhotin and B. V. Shekhvatov, Institute of Oceanology, "Application of Side-View Sonar in Studying Sand Waves on the Floor of the White Sea"]

[Abstract] The purpose of this communication is a report on some results of studies carried out on the White Sea Expedition of the Institute of Oceanology. On the expedition specialists studied tidal sand waves, employing current meters and side-view sonar. The objective was the detection of sectors with sand waves on the shelf of the Solovetskiye Islands and their mapping. It was found that in this shelf area there are eight sectors with sand waves although their existence was denied a few years ago. It was possible to determine the boundaries, form and geographical position of the sand wave fields. In each field it was possible to discriminate different series of sand waves, their relative position was ascertained and the geometric parameters of the sand waves were found. It was found that for obtaining the highest-quality images of sand waves using a side-view sonar its towable part must be towed at a distance of 25-30 m from the bottom with a speed of not more than four knots. The course of the vessel must be selected in such a way that the angle between its direction and the fronts of the sand waves from the direction of their gentle slope is  $15-25^\circ$  for waves with undulating fronts and  $90^\circ$  for waves with straight fronts.

[100]

#### ATTENUATION OF INTERNAL GRAVITATIONAL WAVES

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 12, No 10, 1976, pp 1115-1117

[Article by A. K. Sinitsyn and V. Ye. Fertman, Institute of Heat and Mass Exchange, Belorussian Academy of Sciences, "Attenuation of Internal Gravitational Waves in the Layer of a Viscous Heat-Conducting Fluid"]

[Abstract] A study was made of the influence of viscosity and heat conductivity on the characteristics of two-dimensional large-scale internal gravitational waves in a model of a horizontal layer of a fluid with free boundaries heated from above. The authors have found the temporal and spatial decrements of attenuation, with the principal characteristics of weakly attenuating waves. The article gives the main results obtained from the theory of free internal gravitational waves in a layer of a heat-conductive fluid. It was found that the logarithmic decrement of attenuation of free waves  $\delta_t = 2\pi\omega/\omega_r$  has a minimum when  $k_0 = n\pi/\sqrt{2}$ . The minimum decrement  $\delta_t^* = \delta_t(k_0)$  increases with deviation of the Prandtl number from unity. With an increase in the absolute value of the Rayleigh number  $\delta_t^*$  decreases appreciably. In

a layer of viscous heat-conducting fluid with  $Pr \neq 1$  the range of admissible frequencies of internal waves is narrowed in comparison with a layer of ideal fluid. There is an optimum wavelength at which the decrement  $\delta_t^*$  is minimum. The region of weak attenuation is limited by negative Rayleigh numbers which are large in absolute value. Thus, in a horizontal layer of a viscous, heat-conducting fluid with sufficiently large negative Rayleigh numbers there can be weak attenuation along the layer of internal gravitational waves if the frequency is close to half the Väisälä-Brent frequency. [99]

#### REFLECTION OF LONG WAVES FROM WALLS OF A ROTATING CHANNEL

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 12, No 10, 1976, pp 1081-1087

[Article by A. A. Zaytsev, Atlantic Division, Institute of Oceanology, "Reflection of Unsteady Long Waves from the Walls of a Rotating Channel"]

[Abstract] A study was made of successive reflections of unsteady long waves from the walls of a rotating channel. The long waves are excited by an impulse source in a rotating infinitely long channel of the constant depth  $h$ . It is assumed that the channel rotates counterclockwise with the frequency  $f/2$ . The right-hand rectangular coordinate system is selected in such a way that the channel walls are the planes  $x = 0$  and  $x = a$ . The ordinate axis is directed parallel to the plane of the bottom. In this formulation the field of the incident and reflected waves is based on a generalized interpretation of the successive reflections method. The article gives the expansion of fluid movements into Poincaré waves, Kelvin waves and geostrophic movement. The principal peculiarities of the wave field in the channel are given. [99]

#### GEOLOGICAL POSSIBILITIES OF MARINE MAGNETOMETRY

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 231, No 1, 1976, pp 64-67

[Article by B. D. Uglov, Ya. P. Malovitskiy and Corresponding Member USSR Academy of Sciences V. V. Fedynskiy, Southern Scientific-Productive Geological-Geophysical Combine, Southern Division, Institute of Oceanology, and Moscow State University, "New Geological Possibilities of Marine Magnetometry"]

[Abstract] In 1974 an experimental hydromagnetic survey with a quantum helium magnetometer was carried out in sectors of the northeastern shelf of the Black Sea. The survey was run in a system of latitudinal and meridional profiles with a distance of about 200 m between runs. The threshold response of

these magnetometers exceeded 0.05 gamma. A similar magnetometer was set up on the shore near the work region. The instrumentation was developed on the initiative of the authors at L'vov State University and at the Physical Mechanics Institute Academy of Sciences Ukrainian SSR. The principal measurement error was from errors in the place of determination of observations, which was  $\pm 30$  m. Survey data were used in compiling a map with a contour interval of 1 gamma. The investigated sector was a small depression in the bottom relief with sea depths of 10-20 m. The article is accompanied by maps of isolines of the anomalous magnetic field, geological cross section and geological map of the area based on previously collected data and using materials from the magnetometric survey. The example of this survey shows that with joint use with geological data already available, magnetometric data can be used in carrying out geological mapping of sedimentary bed rock on the shelf. Therefore, the experiment reveals important new possibilities of highly precise marine magnetometry for a detailed study of the structure of the sedimentary stratum on the shelf. The method can be used in marine prospecting.

[97]

#### DEVELOPMENT OF PLANE INTERNAL WAVES

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V98

[Abstract of article by S. F. Dotsenko; Sevastopol', MOR. GIDROFIZ. ISSLED., No 3(70), 1975, 86-95, "Development of Plane Internal Waves in an Exponentially Stratified Flow of Finite Depth"]

[Text] A study was made of the plane flow of an ideal stratified nonrotating fluid. The density changes exponentially with depth: the depth of the fluid is constant. At the initial moment in time an atmospheric pressure which is constant in time but dependent on the horizontal coordinate is applied to the free surface. Solution of the linear problem is written through the Laplace transform in time and the Fourier transform in the horizontal coordinate. The authors examine the velocities of propagation of surface and internal waves and different types of attenuating and nonattenuating waves are defined. Bibliography of eight items.

[109]

#### SMALL-SCALE TURBULENT STRUCTURE OF OCEAN

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V47.

[Abstract of article by A. G. Kolesnikov and N. A. Panteleyev; Sevastopol', ISSLED. TURBULENT. STRUKTURY OKEANA, 1975, pp 17-19, "Investigations of Small-Scale Turbulent Structure in the Ocean"]

[Text] This is a review of the results of investigations carried out during the last 10 years. It is noted that the most important directions in research and in developing observation methods and corresponding measuring devices attained significant successes only during the last three to five years. The first results obtained in investigations of the fine vertical structure of the ocean and later investigations have made possible a considerable refinement of our concepts concerning the turbulent structure of the ocean and the mechanism of generation of small-scale turbulence. The authors give the results of studies carried out at the Marine Hydrophysical Institute Ukrainian Academy of Sciences and also data on the measuring apparatus used at the institute. Bibliography of 17 items.

[109]

#### FINE VERTICAL STRUCTURE OF HYDROPHYSICAL FIELDS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8V 18

[Abstract of article by A. G. Kolesnikov, G. Yu. Aretinskiy and V. Z. Dykman; Sevastopol', ISSLED. TURBULENT. STRUKTURY OKEANA, 1975, pp 59-64, "Investigation of the Fine Vertical Structure of the Ocean"]

[Text] This paper gives some results of the first measurements carried out using a submergible speed of sound probe developed at the Marine Geophysical Institute Ukrainian Academy of Sciences. The design of the instrument makes it possible to decrease the interval of discreteness of measurements in the vertical direction to 1 cm and the method used for transmitting information makes it possible to carry out measurements to great depths. Synchronous measurements of the speed of sound and water temperature make it possible to detect the fine structure of the water density profile. A corresponding variant of the submergible probe is now undergoing testing at the institute.

[109]

#### IV. TERRESTRIAL GEOPHYSICS

##### News

##### DEVELOPMENT OF UNIFIED SEISMIC OBSERVATIONS SYSTEM

Moscow VESTNIK AKADEMII NAUK SSSR in Russian No 10, 1976, pp 30-36

[Article by Academician M. A. Sadovskiy and N. V. Kondorskaya, "Prospects for the Development of a Unified Seismic Observation System in the USSR"]

[Abstract] The Unified Seismic Observation System in the USSR consists of reference and regional stations combined into networks. The reference network is intended for a study of strong earthquakes in the territory of the USSR and throughout the world and for obtaining necessary materials for investigating the internal structure of the earth. In order to limit the number of reference stations great care was taken to ensure their rational distribution. The scientific direction of the reference network is the task of the Institute of Physics of the Earth. The regional seismic stations are intended for studying the seismic regime and structure of the earth's crust. They are affiliated with 17 seismological institutes in different regions of the USSR and are combined into seven zonal networks regardless of affiliation. The network includes 60 reference and 155 regional seismic stations. They conduct continuous galvanometric registry and more than a million seismograms per year are registered. The future work of the network is discussed. In addition to the traditional collection of information on hypocenter, magnitude, nonclosures, the station network will be used in determining the mechanism of earthquakes, seismic moment and spatial properties of the focus. With the availability of special processors for the Fourier transform it will also be possible to determine the spectra of the fundamental waves. Data will be obtained for describing the earthquake focus not as a point but as a discontinuity with geometric and dynamic characteristics. Statistical processing of data on groups of earthquakes for the principal seismological structures will make it possible to refine the characteristics of their seismic activity and trace significant changes in seismicity in time and space. Experience with such work in the Kamchatka polygon, where the daily transmission of data from seismic stations to the processing center has begun, has made it possible to carry out trial routine prediction of earthquakes.

[94]

# EARTHQUAKE REPORTED NEAR DUSHANBE

Moscow IZVESTIYA in Russian 3 Nov 76 p 4

[Unsigned article: "Underground Shocks"]

[Text] Residents of the Tadzhik capital and its environs were awakened by strong underground shocks on the night of 2 November. These were followed by dull sounds coming from the earth's depths. Within apartments dishes shook, chandeliers swayed and glasses rang.

As I. Vybornov, head of the seismic station in Dushanbe, reported to an IZVESTIYA correspondent, the epicenter of the earthquake was 32 kilometers west of the republic capital near the village of Shakhrinav. According to preliminary data, the strength of the tremors at the epicenter exceeded force 5 to 6. The present earthquake is the 26th to be felt since the beginning of the year.

In all, seismographs have registered nearly 3,000 earthquakes in Tadzhikistan in 1976. However, residences, public buildings and industrial structures built with respect to force nine shocks sustained all testing of the elements. Earthquake-resistant construction carried out on a scientific basis has provided safe and reliable buildings.

### Abstracts of Scientific Articles

#### TECTONIC LINEAMENTS AND RELATIONSHIP TO EARTHQUAKE FOCI

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 230, No 6, 1976, pp 1310-1313

[Article by V. I. Bune, V. D. Skaryatin, T. P. Polyakova and Ye. A. Shirokova, Moscow State University, "Map of Tectonic Lineaments and Distribution of Foci of Earthquakes with  $M \geq 6.3$  in the Central Part of the Alpine Folded Region"]

[Abstract] The article cited above examines the correlation of lineaments discriminated on space photographs and earthquake foci for the central part of the alpine folded region (Fig. 1 is a map of the tectonic lineaments in this region based on space photography and corresponding seismicity data). The photos from "Zond-7" were used. In general, the levels of generalization were  $10^8$ ,  $10^7$ . The data considered were earthquakes with  $M \geq 6.3$  for the 20th century and the strongest earthquakes for the 19th century for which the epicenters are known with an accuracy to  $\pm 0.5^\circ$ . It was found that in the overwhelming majority of cases the earthquake foci appeared on lineaments and in zones of intersection of several lineaments. The map shows 41 intersections. Sometimes several lineaments intersect at one place, as in the Gazli region. The sectors of intersection of two lineaments in some cases converge, forming a complex tectonic node. During the last 80 years there have frequently been strong earthquakes at nodes situated in Western and Eastern Turkey, in southern Iran and in the Kopetdag region. There are relatively few complex nodes where strong earthquakes did not occur during this time. Until 1976 the node in the Gazli area was not very active. But with few exceptions, all the mapped intersections of tectonic lineaments must be regarded as seismically dangerous. This has been confirmed by recent events at Gazli. The approach given here is still another means for localizing the sites of potential seismic events.

[93]

## PROCEDURES IN RADIOGEODETIC MEASUREMENTS

Moscow REFERATIVNYY ZHURNAL, GEOLOGIYA, SVODNYY TOM in Russian No 7, 1976, 7D112

[Abstract of article by A. M. Lozinskaya and Yu. V. Podkolzin; Moscow, RAZVED. GEOFIZIKA, No 71, 1976, pp 122-128, "Computation of Coordinates of Points from Radiogeodetic Measurements in Regional Aero- and Marine Geophysical Surveys"]

[Text] The authors have proposed and carried out practical tests of a new method for computer computation of the results of radiogeodetic measurements by means of which it is possible to compute the coordinates of points on profiles not only in the central zones of the phase field, but also near the continuation of base lines. In these zones the ordinary formulas give an indefinite value.

[95]

## INVESTIGATIONS OF BOTTOM RELIEF AND GEOMAGNETIC FIELD

Moscow REFERATIVNYY ZHURNAL, GEOLOGIYA, SVODNYY TOM in Russian No 7, 1976, 7A355

[Abstract of article by V. V. Polyakov; Kiev, EKSPEDITSION. ISSLED. V YUZHNO-ATLANTIKE I SREDIZEM. MORE, "Nauk. Dumka," 1975, pp 32-35, "Investigations of Bottom Relief and the Geomagnetic Field on the 27th Voyage of the Scientific Research Vessel 'Mikhail Lomonosov'"]

[Text] Specialists carried out measurements of depth along the track of the 27th voyage of the "Mikhail Lomonosov" with a total length of 29,945 km and surveyed the geomagnetic field over a distance of 12,131 km. Coordination of measurement and hydromagnetic work was carried out on the basis of 203 determinations of the ship's position. Bottom relief along the shores of Liberia, the Ivory Coast and then through the Guinea Basin to Annobon Island is characterized by a quiet shelf, smooth continental slope, and considerable nonuniformity in the zone of contact between the continental platform and the oceanic crust. In the central part of the Gulf of Guinea there are underwater mountains with an elevation up to 3,500 m, evidently of volcanic origin. A trans-Atlantic crossing was made with investigations of the Brazilian Basin, etc., in the region of the absolute geomagnetic minimum. There were found to be two abyssal trenches which are probably extensions of the Chain and Romanche trenches. There is a sector of upwelling with a water temperature at the surface of 13.9°. During work in the first biological polygon along the shores of Southwest Africa the fluctuations in the sound-scattering layers correlated clearly with fluctuations of the isotherms, as has been noted before.

[95]

#### EXPERIMENTAL TRAVEL-TIME CURVE OF PcP WAVE

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 231, No 1, 1976, pp 61-63

[Article by S. D. Kogan, Physics Institute, "Experimental PcP Wave Travel-Time Curve"]

[Abstract] The Jeffreys-Bullen travel-time curve for the PcP wave reflected from the earth's crust was computed for a radius of the core  $R = 3,473$  km and distributions of velocity with depth obtained using the P wave. The sufficiently great number of observations of the PcP wave (about 400 arrivals) with surface sources with precisely known parameters made it possible to construct an experimental travel-time curve without any assumptions concerning the depth of the reflection boundary and the nature of distribution of velocity with depth. In the materials presented in this paper one can see that the joint use of experimental travel-time curves of P and PcP waves makes it possible to refine the structure of the transition zone from the mantle to the core and the radius of the earth's core.

[97]

#### EARTHQUAKES, NONUNIFORMITY OF ROTATION OF EARTH, D-WAVES

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 230, No 6, 1976, pp 1314-1317

[Article by Sh. A. Guberman, Institute of Applied Mathematics, "Earthquakes, Nonuniformity of the Earth's Rotation and D-Waves"]

[Abstract] In earlier studies (Sh. A. Guberman, DAN, Vol 224, No 3, 1975, Vol 230, No 4, 1976) the author discussed the hypothesis: at times when the velocity of the earth's rotation attains a minimum D waves are formed at the poles and these are propagated along the meridians with the velocity  $v_D$  equal to  $0.15^\circ$  per year in places where there is an accumulation of adequate stresses and earthquakes are initiated. Other authors have established a direct correlation between the time of appearance of strong earthquakes and slowing of the earth's rotation. The findings of these authors (A. Stoyko, ANNALES GUEBHARD, 46 annee, 293, 1970; D. L. Anderson, SCIENCE, Vol 186, No 4158, 1974) are used in this paper for further checking of the hypothesis set forth in earlier studies by Guberman. Data from China, Japan and Turkey are considered in detail. The results presented here confirm not only the presence of D-waves and their correlation with the nonuniformity of the earth's rotation, but also coincidence of the times of appearance of very strong earthquakes with the times of the local minima of the earth's rate of rotation. Within the framework of the formulated concept the moments of strong earthquakes are predetermined in advance by: a) the position of places where strong earthquakes are possible (and they are invariable with

time) and b) the moments of arrival in these places of D-waves which can be computed hundreds of years in advance. Accordingly, earthquakes must be regarded as a cause and changes in the rate of rotation -- an effect.  
[93]

#### EXPERIMENTAL P-WAVE TRAVEL-TIME CURVE AND MANTLE INHOMOGENEITY

Moscow DOKLADY AKADEMII NAUK SSSR in Russian Vol 230, No 6, 1976, pp 1318-1321

[Article by S. D. Kogan, Institute of Physics of the Earth, "Experimental Travel-Time Curve of the P Wave and Horizontal Inhomogeneity of the Mantle"]

[Abstract] For five different experimental regions  $j$  with precisely known coordinates of the epicenters and focal time for 120 surface sources, the author processed about  $4.5 \cdot 10^3$  arrivals of the P wave at 700 seismic stations in the world. These data were used in computing the deviations  $\Delta t$  of the observed travel time of the P wave for each  $i$ -th station from the travel time  $t$  using the Jeffreys-Bullen travel-time curve for epicentral distances from  $0.1^\circ$  to  $105^\circ$ . An analysis of all the data indicates that the observed correction is dependent on epicentral distance  $\delta$ , observation site and focal region  $j$ . The paper gives a method for computing the regional corrections. Figure 3 is a world map with defined regional boundaries. A table gives a comparison of the regional corrections for tectonic zones of the same types. Comparison with a map of heat flows shows that the regions for which the regional corrections indicate increased travel time of the P wave will correlate with regions of high heat flow values; in regions with low heat flows the travel times for the P wave are less. It was found that the horizontal inhomogeneity of the lower mantle is of approximately the same order of magnitude as the horizontal inhomogeneity of the upper mantle.  
[93]

#### SEISMOLOGICAL PREDICTION IN RUMANIA

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8G157

[Abstract of article by Vasile Lazarescu and Matei Trimbitasu; Bucharest, STUD. TECHN. SI ECON. INST. GEOL. SI GEOFIZ., D, No 10, Part A3-a, 1975, pp 319-323]

[Text] The geological approach was used for evaluating and predicting the seismic activity of the Vranca epicentral zone of earthquakes. The paper is accompanied by a map of isolithobars (lines of equal weight in tons per

square meter) constructed on the basis of data from a geological investigation of the region for different deposits. The authors compare the position of these isolines with seismically active geological faults. It was found that lineaments with high seismicity are situated near to or coincide with deep faults in the earth's crust. Bibliography of 11 items.  
[109]

#### MULTIPATH PROPAGATION OF SEISMIC SIGNALS IN CRUSTAL STUDIES

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8G 170

[Abstract of article by I. G. Klushchin; Moscow, TR. VSES. N.-I. GEOL. IN-TA, 223, 1975, pp 113-122, "On the Problem of Multipath Propagation of Seismic Signals Registered During Study of the Earth's Crust"]

[Text] The author investigated the propagation of a seismic wave in a series of inhomogeneous spherical layers. For three typical cross sections of the earth's crust and mantle it was possible to determine approximately the probability of repeated arrivals of one and the same wave caused by remote earthquakes. Bibliography of 13 items.  
[109]

#### ANNULAR STRUCTURES AND LINEAR FAULTS ON ALDANSKIY SHIELD

Moscow GEOTEKTONIKA in Russian No 5, 1976, pp 36-48

[Article by M. Z. Glukhovskiy, "Aerogeologiya" Trust, "Annular Structures and Linear Faults on the Aldanskiy Shield and in the Stanovaya Region"]

[Abstract] As a result of interpretation of television space photographs within the limits of the Aldanskiy shield and Stanovaya region it was possible to detect earlier unknown concentrically annular structures formed by systems of long-lived arcuate and annular faults. Two photomaps were compiled at a scale of approximately 1:5,000,000; these were prepared from rectified TV photographs obtained using the satellites "Meteor-13" and "Meteor-14." The formation of these structures dates to the early (lunar) stage in the earth's development. It was also possible to interpret linearly banded zones of "disperse permeability" (megacleavage) of a north-westerly strike which conform to the strike of granitized formations and swarms of dikes of the early Precambrian, giant fissured intrusions of granitoids and a number of other structural-mineralogical complexes. Comparison of the fault tectonics of the lunar maria, having a concentrically annular structure, with the interpreted structural complexes of the Aldanskiy shield and the Stanovaya region indicates a closeness of their

parameters, similarity of concentric structure and similarity of the network of faults with a predominating northwesterly strike. On the moon this network is oriented relative to the poles of its rotation. Such a mechanism is also possible for the formation of ancient tectonically weakened zones of NW strike on the Aldanskiy shield.  
[111]

#### ACCURACY OF GEODETIC TIE-IN IN MARINE SURVEYS

Moscow GEODEZIYA I KARTOGRAFIYA in Russian No 9, 1976, pp 25-29

[Article by B. Ye. Ivanov, "Effect of the Accuracy in Geodetic Tie-in on the Quality of Surveys in the Seas and Oceans"]

[Abstract] The quality of any survey carried out on the shelf and in the open regions of the ocean is characterized not only by the accuracy in measuring the studied parameter, but also by the discreteness interval, the accuracy in determining the corrections to be taken into account, the accuracy of geodetic tie-in and the nature of the investigated field. As the survey quality it is customary to use the total mean square error in determining the studied parameter, which consists of the individual mean square errors of components. In this article the author proposes methods for obtaining one such individual error -- the mean square error in determining the studied parameter as a result of the error in geodetic tie-in. In the appropriate computations it is necessary to use the elements of the ellipse of errors in determining position, the law of the distribution of the gradient of the parameter or the constant, mean square value of the gradient.  
[113]

#### PROBLEMS IN THE THEORY OF TECTOGENESIS

Kiev GEOFIZICHESKIY SBORNIK in Russian No 70, 1976, pp 7-12

[Article by S. I. Subbotin, Geophysical Institute, Ukrainian Academy of Sciences, "On Problems in the Theory of Tectogenesis"]

[Abstract] During recent years an ever-increasing flow of diversified information on the structure of the earth's crust and mantle and the processes transpiring in them is making possible a sounder, than earlier, formulation of hypotheses on the causes of tectogenesis and its pattern. One of these attempts is the proposed hypothesis, in which the earth is regarded as a thermodynamic system rotating with a discretely variable velocity. Centers of additional geodynamic and thermoelastic stresses arise in the inhomogeneous mantle and there is a change in the volume of mantle

matter which is the cause of tectonic movements and formation of structural forms in the earth's crust. In addition, during recent years geologists have been discovering an ever-increasing number of structures of the annular type. The reason for their formation is the total forces arising in blocks of inhomogeneities in the tectonosphere and the translational-rotational movements imparted to them. On the periphery of the blocks fault zones are formed, within which, and also within the annular structures, additional geodynamic and thermoelastic stresses appear, leading to a change in the volume of matter due to its phase, polymorphous and other transformations.

[110]

#### AIRCRAFT MEASUREMENT OF GRAVITY

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8D 210

[Abstract of article by A. M. Lozinskaya, V. Ye. Mogilevskiy, V. Ye. Popkovskiy, S. G. Popkov, V. V. Fedynskiy and I. L. Yashayayev, 1976, pp 165-177, "Gravity Measurement Aboard an Aircraft"]

[Text] The article describes an airborne gravimeter with a "Graviton" digital measuring-recording device. The authors present the results of flight tests of the apparatus carried out in an IL-14 aircraft over the Caspian Sea. The mean square error in an individual gravity measurement, estimated along 44 runs with a total length of 6,300 km, is  $\pm 6.3$  mgal with an averaging time of four or five minutes.

[109]

#### MAGNETIC ANOMALIES ALONG ASHKHABAD-TASHAUZ PROFILE

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8G 47

[Abstract of article by O. A. Odekov, A. A. Yuvshanov, O. Vasov, S. Shadurdyev and G. Begendzhev; Ashkhabad, MATERIALY X NAUCH.-TEKHN. KONF. PROF.-PREP. SOSTAVA. TURKM. POLITEKHN. IN-T, 1976, pp 129-130, "Geological Nature of Magnetic Anomalies Along the Ashkhabad-Tashauz Profile"]

[Text] Magnetic anomalies, attaining a great intensity, are noted in the Predkopetdagskiy marginal downwarp. Here the upper edges of the magnetically active bodies begin with a depth of 2-3 km. It can be seen that this was caused by the penetration of magnetically active rocks into the sedimentary mantle. The principal factor responsible for the increased anomalous field

in the downwarp is the presence of deep faults filled with rocks of a basic composition.

[109]

#### SEISMOTECTONIC MAP OF RUMANIA

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8G 221

[Abstract of article by Liviu Constantinescu, Ion Cornea and Vasile Lazarescu; Bucharest, STUD. TECHN. SI ECON. INST. GEOL. SI GEOFIZ., D, No 10, Part A3-a, 1975, pp 291-298, "Seismotectonic Map of the Territory of Rumania"]

[Text] The authors collected materials on seismology, geology and tectonics for a seismotectonic map of the territory of Rumania. The article gives the characteristics of earthquakes in the Vranca region, whose seismic regime is decisive for the seismicity of the entire territory of Rumania. The foci of earthquakes in the region are situated at an intermediate depth (90-160 km). Bibliography of 15 items.

[109]

## V. UPPER ATMOSPHERE AND SPACE RESEARCH

### News

#### TASS REPORTS "SALYUT-4" STATION'S COMPLETION OF 22 MONTHS IN ORBIT

Moscow PRAVDA in Russian 30 Oct 76, p 2

[TASS Report: "'Salyut-4': 22 Months in Orbit"]

[Text] Flight Control Center, 29 October. The "Salyut-4" orbital scientific station, which was inserted into a near-earth orbit on 26 December 1974, is continuing space research in an automatic mode. By 1200 hours Moscow time on 29 October the station had completed 10,637 revolutions around the earth.

At the present time the orbital parameters of the station are:

- apogee, 307 kilometers;
- perigee, 290 kilometers;
- period of revolution, 90.3 minutes;
- orbital inclination, 51.6 degrees.

The latest series of scientific and technical experiments was performed during the period 22-28 October. In addition, a check was carried out on the operation of the on-board systems in various modes. On 24 October the engine unit was fired to correct the orbit of the "Salyut-4" station. According to telemetry data, the station systems are functioning normally. The information coming from the station is being processed and studied. [4]

#### TASS ANNOUNCES LAUNCHING OF "KOSMOS-864"

Moscow PRAVDA in Russian 30 Oct 76, p 2

[Abstract] The "Kosmos-864" artificial earth satellite was launched in the Soviet Union on 29 October 1976. The satellite was inserted into an orbit with the following parameters:

- initial period, 104.9 minutes;
- apogee, 1,021 kilometers;
- perigee, 980 kilometers;
- orbital inclination, 83 degrees.

## TASS ANNOUNCES LAUNCHING OF "EKRAN" TELEVISION BROADCASTING SATELLITE

Moscow PRAVDA in Russian 28 Oct 76, p 5

[Text] In accordance with the program for further development of television broadcasting systems with the use of artificial earth satellites, on 26 October 1976 the "Ekran" ["Screen"], a new type of television broadcasting satellite, was launched in the Soviet Union. The satellite has an on-board repeater apparatus which provides for transmission of color or black-and-white programs of Central Television to a network of collective-use receiving installations located in populated places in Siberia and the Far North.

The "Ekran" satellite was inserted into a near-stationary circular orbit with the following parameters:

- distance from the earth's surface, 35,600 kilometers;
- period of revolution, 23 hours 42 minutes;
- orbital inclination, 0.3 degrees.

A correction monitor will maintain the satellite in constant position relative to the earth's surface.

In addition to an improved repeater apparatus, the satellite carries: a triaxial system for precise orientation toward the earth, a power supply system with independent aiming and tracking of the solar cells on the sun, a system for orbital corrections, a radiotelemetry system for transmitting to earth data on the operation of the on-board systems, and a radio system for precise measurement of orbital parameters and monitoring of the satellite.

Operation of the satellite's television apparatus will be performed in accordance with the planned program.

The "Ekran" satellite has the international registration index "Stationar-T."

The apparatus installed on the "Ekran" satellite is operating normally. The command and measurement complex is controlling the satellite. [4]

# TASS ANNOUNCES LAUNCHING OF "KOSMOS-866"

Moscow PRAVDA in Russian 12 Nov 76 p 3

[TASS Report: "'Kosmos-866'"]

[Abstract] The artificial earth satellite "Kosmos-866" was launched in the Soviet Union on 11 November 1976. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.1 minutes;
- apogee, 306 kilometers;
- perigee, 182 kilometers;
- orbital inclination, 65 degrees.

## "EKRAN" SATELLITE PUT INTO STATIONARY CIRCULAR ORBIT

Moscow PRAVDA 12 Nov 76 p 1

[TASS Report: "Satellite 'Ekran' is Operating"]

[Text] Flight Control Center, 11 November. As was already reported, on 26 October 1976 in accordance with the program for further development of TV broadcasting systems using artificial earth satellites, the new "Ekran" satellite was launched in the Soviet Union.

As a result of the correction performed in the trajectory, the satellite transferred to a stationary circular orbit with parameters which guarantee a constant position of the satellite relative to the surface of the earth over a point on the equator at 99°E.

The highly directional antennas and high-power repeater apparatus installed aboard the satellite provide high-quality reception of color programs of Central Television in regions of Siberia and the Far North using collective-use receiving units.

Transmission of Central Television programs to the satellite is carried out from a ground transmission point at a frequency of 6 GHz. Broadcasting from the satellite is performed at frequencies of 702-706 MHz by the frequency modulation method.

On the day of celebration of the 59th anniversary of the Great October Socialist Revolution the "Ekran" satellite was used for experimental direct transmissions from Moscow for the inhabitants of Yakutiya, Krasnoyarskiy Kray, Tuvinskaya ASSR and other remote regions of Siberia which were not covered earlier by the network of "Orbita" stations.

The equipment of the "Ekran" satellite is operating normally. The command and measurement complex is controlling the satellite. [5]

#### TASS ANNOUNCES LAUNCHING OF "KOSMOS-865"

Moscow PRAVDA in Russian 2 Nov 76 p 2

[TASS Report: "'Kosmos-865'"]

[Abstract] The artificial earth satellite "Kosmos-865" was launched in the Soviet Union on 1 November 1976. The satellite was inserted into an orbit with the following parameters:

- initial period, 89.8 minutes;
- apogee, 350 kilometers;
- perigee, 212 kilometers;
- orbital inclination, 72.9 degrees.

The satellite carries a radio transmitter operating at a frequency of 19.995 MHz.

### Abstracts of Scientific Articles

#### DIFFUSE REFLECTION OF RADIATION BY PLANETARY ATMOSPHERE

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 12, No 10, 1976, pp 1053-1066

[Article by O. I. Smoktiy, Leningrad Hydrometeorological Institute, "Precise Solution of the Problem of Diffuse Reflection of Solar Radiation by a Semi-Infinite Planetary Atmosphere Using a Four-Term Scattering Function]

[Abstract] The author has derived a precise analytical expression for the coefficient of reflection for a plane-parallel semi-infinite planetary atmosphere in the case of a four-term scattering function. On the basis of use of similarity relationships and the resulting precise solution the author proposes an effective approximate method for determining the intensity of diffusely reflected radiation at the level of the upper boundary of a semi-infinite planetary atmosphere with arbitrary scattering function and probability of survival of a quantum. The article gives computations of the principal functions and presents their precise values for definite sets of optical parameters of the scattering and absorbing media. It was possible to determine the contribution of single scattering to the azimuthal harmonics of the total reflection coefficient. Also given is an evaluation of the accuracy of some approximate and asymptotic formulas in radiation transfer theory in the case of a four-term scattering function.

[99]

#### MESOSPHERIC TURBIDITY

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian  
Vol 12, No 10, 1976, pp 1024-1033

[Article by G. V. Rozenberg and G. G. Mikirtumova, Institute of Atmospheric Physics, "Mesospheric Turbidity Determined from Twilight Sounding Data"]

[Abstract] The article gives a comparison of two different methods for interpretation of data from twilight soundings for ascertaining mesospheric turbidity. It is shown that they are correct and it is found that the role of secondary scattering is negligible at levels below 80 km. Data from twilight observations are used in finding the vertical variation of the scattering function and air turbidity in the mesosphere. The existence of a mesospheric aerosol layer between altitudes of 40 and 60 km follows on the basis of the turbidity curve and also from a correlation analysis of data on the polarization of light in the twilight sky. The article is organized as follows. 1. Comparison of the two methods for ascertaining the vertical variation of the scattering coefficient. 2. Interference from secondary scattering. 3. Correlation analysis of light polarization of twilight sky at the zenith. 4. Vertical variation of scattering function for air turbidity. 5. Seasonal variation of air turbidity in mesosphere. 6. Mesospheric aerosol layer.  
[99]

#### INVERSE PROBLEM IN OPTICAL SOUNDING

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 12, No 10, 1976, pp 1067-1074

[Article by A. A. Yakovlev, "Properties of Solution of Inverse Problem in Optical Sounding Obtained by the Ranking of Model Components"]

[Abstract] The article describes the information possibilities of the method for balloon optical sounding. The author considers the properties of solution of the inverse problem in the method of ranking of model information components: it was possible to determine the experimental response function in combination with a solution method. The article gives formulas for the matrices of the random and systematic errors in the solution. The stability of the solution to the inadequacy of the a priori model is demonstrated. Also given are the results of a numerical reconstruction of the complex vertical profile of the attenuation coefficient illustrating the advantages of the ranking of model components method.  
[99]

#### SPECTRAL BRIGHTNESS OF NOCTILUCENT CLOUDS

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 12, No 10, 1976, pp 1097-1099

[Article by D. P. Veselov, O. I. Popov, V. I. Semenova, G. I. Seleznev and Ye. O. Fedorova, "Spectral Brightness of Noctilucent Clouds in the Visible and Near-IR Spectral Regions"]

[Abstract] At the present there are virtually no data on the spectral brightness of noctilucent clouds obtained simultaneously in a quite broad spectral region. In the summer of 1974 the authors carried out a series of measurements of the spectral brightness of noctilucent clouds from the earth in the range  $\sim 0.4-1.7\mu\text{m}$ . The measurements were made at the base (and with the cooperation of) the Institute of Aeronomy and Atmospheric Physics Estonian SSR (near Tartu) with an IF-73 filter radiometer and an IF-65SP IR spectrometer with a diffraction grating. (The principal parameters of the instrumentation are tabulated; observation conditions and the method are described.) The mean curve for the spectral brightness of noctilucent clouds in the range  $0.4-1.7\mu\text{m}$  in relative units for  $h_0 \approx -9^\circ$  and a sighting angle above the horizon  $h_{\text{hor}} \approx +6^\circ$ , with all corrections taken into account, is shown in Fig. 3. All the experimental curves have a stronger dependence on wavelength in the short-wave part of the spectrum ( $\lambda < 0.5\mu\text{m}$ ) than the computed curve. It is most probable that these differences are caused by an underestimate of the fraction of the finely disperse fraction in the noctilucent cloud particle size distribution function adopted in the computations. For wavelengths greater than  $0.5\mu\text{m}$  the spectral variation of the brightness of noctilucent clouds on the basis of the results of computations and measurement data agrees well. Figure 4 compares the data obtained in the reported measurements with the results obtained by Fogle and Harrison.

[99]

#### MAGNETIC REGIONS IN STREAMS OF INTERPLANETARY PLASMA

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 5, 1976, pp 771-776

[Article by K. G. Ivanov, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation, "Properties and Nature of 'Magnetic' Regions in Streams of Interplanetary Plasma from Powerful Flares"]

[Abstract] A study was made of the distribution of characteristics of the magnetic field  $F$  and plasma in isolated streams from powerful flares. The author estimates the changes in  $F$  and the concentration  $n$  in the "magnetic" region with increasing distance from the sun and discusses the possible correlation between a typical interplanetary structure and the structure of a moving isolated source of type-IV radio bursts. It is shown that a powerful flare probably generates in the corona a stream having the same structural elements which are observed in the interplanetary medium. This structure should be associated with the hydromagnetic structure of a powerful flare. Examination of different models suggests that preference must be given to the formation of structures in which the plasma is "packed" in the magnetic field and in whose leading part a "magnetic" region can be defined. Such a structure can be formed from some type of large-scale instability of pre-flare configuration with a neutral layer.

[83]

#### EXCITATION OF DRIFT INSTABILITY IN UPPER IONOSPHERE

Moscow GEOMAGNETIZM I AERONOMIYA in Russian Vol XVI, No 5, 1976, pp 783-789

[Article by N. D. Borisov, V. V. Vas'kov and A. V. Gurevich, Institute of Terrestrial Magnetism, Ionosphere and Radio Wave Propagation and Physics Institute, "Excitation of Drift Instability in the Upper Layers of the Ionosphere Under the Influence of a Powerful Radio Wave"]

[Abstract] In the paper cited above it is demonstrated that the large-scale stratification of ionospheric plasma arising under the influence of powerful radio waves on the F layer of the ionosphere can serve as a source of small-scale drift instability. The authors determined the increments of this instability. Their dependence on the parameters of large-scale stratification and the wave vector of excited oscillations are investigated.  
[83]

#### DETERMINING RADIATION TRANSFER EQUATION SOLUTION

Moscow IZVESTIYA AKADEMII NAUK SSSR, FIZIKA ATMOSFERY I OKEANA in Russian Vol 12, No 10, 1976, pp 1102-1104

[Article by V. A. Smerkalov, Institute of Applied Geophysics, "Approximate Method for Solving the Radiation Transfer Equation for Conditions in the Upper Atmosphere for a Known Albedo of the Earth-Atmosphere System"]

[Abstract] In solving the radiation transfer equation for the upper atmosphere ( $h \gg 50$  km) the horizontal plane passing through the observation point can be used as a quasi-underlying surface and as the albedo of this surface one can use the albedo of the earth-atmosphere system. In this paper it is shown that with a known albedo of the underlying surface the solution of the transfer equation is considerably simplified. A final formula for computing the brightness of the upper atmosphere is derived. A figure shows a histogram of the distribution of errors in computing the brightness of the upper atmosphere when using the derived formula.  
[99]

#### PROTON COMPONENT OF RADIATION BELTS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8A347

[Abstract of article by A. S. Kovtyukh, M. I. Panasyuk and E. N. Sosnovets; Moscow, IZV. AN SSSR, SER. FIZ., 40, No 3, 1976, pp 496-501, "Proton Component of the Earth's Radiation Belts Determined from Measurements Aboard the 'Molniya' Artificial Earth Satellite"]

[Text] The paper presents the results of investigations of the differential spectrum of protons in the energy range from  $\sim 30$  keV to  $\sim 1$  MeV on the basis of observations using satellites of the "Molniya-1" and "Molniya-2" series between 1970 and 1974. The structure of the spatial distribution and temporal variations of the proton component in different energy intervals is analyzed. Bibliography of 21 items.  
[109]

#### DYNAMICS OF ELECTRONS IN RADIATION BELTS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8A 348

[Abstract of article by P. V. Vakulov, L. M. Kovrygina, Yu. V. Mineyev and L. V. Tverskaya; Moscow, IZV. AN SSSR, SER. FIZ., 40, No 3, 1976, pp 502-509, 1976, "Dynamics of High-Energy Electrons in the Earth's Radiation Belts During Magnetic Storms"]

[Text] On the basis of data from the differential electron spectrometer carried aboard the "Molniya-1" artificial earth satellite, a study was made of variations in the intensity and spectrum of high-energy electrons in the earth's radiation belts during the time of magnetic storms in December 1972-May 1973. The electrons were measured in three energy ranges: 0.3-0.6, 0.6-0.9 and 0.9-2.3 MeV. Bibliography of 26 items.  
[109]

#### GROUND METHODS FOR INVESTIGATING COSMIC RAYS

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8A 166

[Abstract of article by T. M. Aleksan'yan, V. M. Bednazhevskiy, Ya. L. Blokh, R. T. Gushchina, L. I. Dorman, I. Ya. Libin, F. A. Starkov and V. G. Yanke; Moscow, IZV. AN SSSR, SER. FIZ., 40, No 3, 1976, pp 646-650, "Development of Ground Methods for Investigating Cosmic Ray Variations"]

[Text] A study was made of the problems involved in achieving accuracy in registering the intensity of cosmic rays, taking into account the law of distribution of fluctuations of different components. The article describes a system for automatic exclusion of random coincidences. Included is a detailed investigation and computations of the coupling coefficients for stars of different multiplicity. Bibliography of 12 items.  
[109]

#### MAGNETIC VARIATIONS IN POLAR REGION

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8A 176

[Abstract of article by Ya. I. Fel'dshteyn; Moscow, MEZHPLANET. MAGNIT. POLYA I GEOFIZ. YAVLENIYA V VYSOKIKH SHIROTAKH, 1975, pp 3-94, 127, "Structure of Field of Magnetic Variations in the Circumpolar Region and Interplanetary Magnetic Fields"]

[Text] This is a review of results of analysis of geomagnetic variations in the circumpolar region obtained during the last four years. Particular attention is devoted to the correlation between these variations and components of the interplanetary magnetic field (IMF). Quantitative relationships were obtained between the intensity of circumpolar variations and the azimuthal component  $B_y$  of the IMF, on the basis of which a method is proposed for diagnosis of  $B_y$  of the IMF on the basis of ground observations. Existing concepts on structure of the field of magnetic variations in the circumpolar region are refined. Bibliography of 90 items.  
[109]

#### ARTIFICIAL IONIZATION OF IONOSPHERE

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8A 81

[Abstract of article by A. V. Gurevich, G. M. Milikh and I. S. Shlyuger; Moscow PIS'MA V ZhETF, 23, No 7, 1976, pp 395-399, "Artificial Ionization of the Ionosphere Under the Influence of Powerful Radio Waves"]

[Text] The authors have discovered an increase in the electron concentration in the lower ionosphere under the influence of high-intensity radio radiation.  
[109]

#### INVERSE PROBLEM OF GLOBAL IONOSPHERIC SOUNDING

Moscow REFERATIVNYY ZHURNAL, GEOFIZIKA, SVODNYY TOM in Russian No 8, 1976, 8A224

[Abstract of article by V. Yu. Kim and L. D. Shoya; Moscow, IONOSFERN. RASPROSTRANENIYE KOROTK. RADIOVOLN, 1975, pp 82-89, "On the Inverse Problem in Global Ionospheric Sounding"]

[Text] A study was made of the characteristics of propagation of decameter radio waves in spherically stratified ionospheric waveguides formed by a  $N(h)$  profile with a "valley" and with its monotonic equivalent obtained on the basis of data on the group lag of two magneto-ionic components during vertical sounding of the ionosphere. The structure of the quasimonochromatic signals, propagating in such waveguides, has substantial differences. This can be used in evaluating the interlayer ionization along the propagation path. Bibliography of four items.

[109]

## VI. MISCELLANEOUS

### News

#### SCIENTISTS DEPART FOR ANTARCTIC EXPEDITION

Moscow PRAVDA in Russian 27 Oct 76, p 3

[TASS Report: "To the Shores of the Antarctic"]

[Text] The flagship of the Antarctic fleet, the diesel-electric "Mikhail Somov," left Leningrad today, having set course for the shores of the sixth continent. Aboard the ship is a large group of participants in the 22d Soviet Antarctic Expedition.

A great complex of oceanographic work is to be performed by the marine group of the USSR expedition for the international program "Poleks-Yug" [Polex-South]. Its participants are being transported to the "white continent" by seven scientific research ships, diesel-electric ice-class vessels and passenger liners. Such a large fleet under the Soviet flag has never before approached Antarctic shores.

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